ASSESSING LIFE-SPACE IN A POPULATION WITH SERIOUS MENTAL ILLNESS

by
Saul Graham Feinstein

A thesis submitted to Johns Hopkins University in conformity with the requirements for the degree of Master of Science

Baltimore, Maryland
April 2016

ABSTRACT

Background and Objective: The Life-Space Assessment (LSA) is a validated tool that quantitatively measures mobility patterns in community dwelling older adults. Decreased life-space in this population is generally a strong indicator of limited physical function. However in a population with serious mental illness (SMI), decreased life-space may be an indicator of other impairments and barriers pertaining to mental, physical and psychosocial health. Measuring life-space in this population offers a novel opportunity that could address these underlying associations. Specific interventions could target ways to improve mobility once the associations are examined.

Methods: A secondary analysis from the ACHIEVE trial was conducted. The trial was a successful behavioural weight-loss intervention that focused on promoting physical activity and healthy eating for persons with SMI. Life-space measurements were measured at baseline, 6-month and 18-month follow-up visits. Four different sub-scales measured life-space: the composite sub-scale, a daily sub-scale and a daily sub-scale for days when a person visited a psychiatric rehabilitation program (PRP) or did not. Measures pertaining to mental, physical and psychosocial health were assessed for their relationship on life-space at baseline and over follow-up.

Results: For 198 participants at baseline the mean age was 45.5 (SD=11.0), over 55% had schizophrenia or a schizoaffective disorder, 22% had bipolar disorder, 14% had major depressive disorder, and about 63% of the whole population presented with depressive symptoms based on the CES-D cut-off of 16 points or more. Positive affect

was associated with an increase in all four of the LSA sub-scales at baseline while somatic symptoms were associated with a decrease in the daily sub-scale. Over time, decreasing life-space was associated with depressed affect and fewer activities with neighbors for days in which participants did not go to the PRP, but not for days in which they did. A decreasing life-space composite score and daily score were associated with problems surrounding interpersonal relationships and less social cohesion, respectively.

Conclusions: The findings of this novel study suggest that life-space can be used to assess mobility patterns for persons with SMI and that this dimension of health can provide insight into a previously undocumented measure of health. The associations were more pronounced on days that individuals did not visit the PRP, indicating that social isolation could be associated with reduced mobility. The association between decreasing life-space and worse health outcomes that have been established in community dwelling older adults were also observed in this population. Promoting social engagement could increase mobility as well as subsequent health in this population.

Readers: Dr. Gail Daumit, Professor William Eaton and Dr. Joseph Gallo

Acknowledgement

I would like to thank Courtney Cook who provided me with countless datasets that I needed to conduct these analyses. Without her incredible ability to speedily create clean datasets, this task surely would have been impossible. I am in many ways indebted to her for helping me finish my thesis on time. I would also like to thank Dr. Gerald Jerome who was an expert in introducing me to life-space. Dr. Jerome (Jerry) helped me come up with analytic strategies for the exploratory data analyses as well providing insight into the conceptual framework for my thesis. My meetings with Jerry were important stepping stones in completing my thesis and his time and effort have been monumentally appreciated.

When I was first trying to come up with an idea for my thesis I knew that I had interests in both chronic physical illness as well as mental illness. I remember reading a paper in Epidemiology Methods II titled "A Behavioral Weight-Loss Intervention in Persons with Serious Mental Illness" that was one of the most inspired studies I had ever read. I sought out the author who said that she had large amounts of data left over from the trial and was happy to be my thesis advisor. Without Dr. Gail Daumit vision, this research would not be possible. I am so thankful to Dr. Daumit because she allowed me pursue a novel area of research that I hope can help facilitate a greater understanding into the lives of people with serious mental illness. Having family that suffer and having depression myself, I feel personally involved in this research. I look forward to working with Dr. Daumit in the near future and I feel privileged that she agreed to be my advisor for this thesis.

I would also like to thank Dr. William Eaton for being my second thesis reader. I took Dr. Eaton's Psychiatric Epidemiology class this year where I read his book "Public Mental Health". These sorts of compendiums are essential in any field and I feel that Dr. Eaton has created one of the most important books for psychiatric epidemiology. I will always use it as a reference until the newest edition comes out! Then I will use that too.

Dr. Joseph Gallo kindly agreed to be my joint-second reader. I really enjoyed his class on the intersection of physical and mental health and partaking in this discourse is critical for understanding health on a holistic level. Thanks Joe!

I would also like to thank Dr. Elizabeth Selvin for welcoming me into the Welch center. Assigned as my academic advisor, Liz was always available when I had questions regarding school work or time tables. I am very thankful for her guidance.

Without the help and support from my friends, this would have been a miserable experience. I am eternally grateful for my Epi cohort as well as my friends and colleagues in other departments. We entered the program unsure of what epidemiology truly was and now we can call ourselves epidemiologists (or at least budding ones)! This has been a cherished and challenging past two years.

I am very grateful for this experience and I look forward to continuing my career in public health, and in particular, studying and advocating for mental health.

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX

INTRODUCTION

Persons with serious mental illness (SMI) predominantly constitute a population with clinically diagnosed bipolar disorder (BD), major depressive disorder (MDD) and schizophrenia. According to a recent meta-analysis by Eaton et al., 2012, the median one-year prevalence in the US population for schizophrenia is approximately 0.5% (IQR: 0.3-0.6) and bipolar disorder has a similar one-year median prevalence of 0.6% (IQR: 0.3-1.1). Major depressive disorder at 5.3% (IQR: 3.6-6.5), has a less precise estimate since there is a greater degree of variability in diagnosis due to the manifestation of symptoms (Eaton et al, 2012). SMI can include other forms of mental illness that have been diagnosed in the past year based on DSM-IV criteria. SMI may also be defined by functional impairment due to an emotional or behavioral disorder (Kessler et al., 2005; Center for Behavioral Health Stat., 2015).

Individuals with SMI are particularly vulnerable to medical co-morbidities including obesity, diabetes, dyslipidemia, hypertension and heart disease as well infectious diseases such as HIV and Hepatitis B and C (Jones et al., 2004; Baughman et al., 2015; Daumit et al., 2010; Druss et al., 2011; Heald et al., 2016; Daumit et al., 2003). Compounding the issue of obesity-related illness, psychotropic medications that are essential for managing their symptoms are also a significant cause of weight-gain due to the side effect of increased appetite (Daumit et al., 2013; Avila et al., 2015; Naslund et al., 2015). The most common cause of death in this population is from cardiovascular disease (Baller et al., 2015; Daumit et al., 2013). Overall, people with SMI have mortality rates that are two to three times higher than the general population (Daumit et al., 2013; Piatt, Munetz and

Ritter, 2010; Miller, Paschall and Svendsen, 2006). According to one global estimate, the average life span for people with any mental health disorder is significantly reduced by 10-15 years (Walker, McGee and Druss, 2015; Druss et al., 2011). This premature mortality is primarily attributed to physical co-morbidity rather than the mental illness itself (Druss et al., 2011; McGinty et al., 2015).

There have been many well-documented measures to quantify the extent of physical, mental and psychosocial health in persons with SMI (Gardsjord et al., 2016; Oldis et al., 2016; Gutierrez-Rojas et al., 2008). However, one health indicator that has yet to be studied in this population is mobility patterning.

There are multiple factors that may influence the extent of mobility for persons with SMI. These individuals are more likely to experience social isolation due to alienation and stigma (Linz and Sturm, 2013; Adams, Ritter and Bonfine, 2015), while social isolation itself is a particularly strong marker of depression (Matthews et al., 2016; Choi, Irwin and Cho, 2007). In addition to this, persons with SMI are often dealing with active mental health symptoms on a daily basis and this may leave other forms of self-care, including healthy eating and exercise, as a secondary priority (Casagrande et al., 2010; Jerome et al., 2009; Aschbrenner et al, 2012). People with SMI are more likely to be undereducated, unemployed, single or divorced and in fluctuating or unstable housing situations (Druss et al., 2011; Piatt et al., 2010). They are more likely to be living in poor neighbourhoods, while also living with and witnessing violence and social distress (Adams et al., 2015). As such, the combined effects of mental illness, lack of physical

activity, social isolation and unfavourable neighborhood characteristics could be strongly associated with their mobility patterns.

For this study, the Life-Space Assessment (LSA) questionnaire will quantitatively measure mobility patterns at baseline and over follow-up. The assessment is designed to measure a person's movement and frequency of movement in their immediate environment. It has been validated as a way to measure mobility in community dwelling older adults (Baker et al., 2003; Peel et al., 2005; Stalvey et al. 1999). At baseline, the LSA is predictive in that lower scores are associated with worse physical and mental health outcomes (Baker et al., 2003; Peel et al., 2005; Crowe et al., 2008; Polku et al., 2014; Portegijs et al., 2014; Lo et al., 2014; Bowling et al., 2014; Ritchie et al., 2008) as well as mortality (Boyle et al., 2010). The LSA can track mobility trajectories over time (Baker et al., 2003; Baker et al., 2015). For longitudinal studies, decreasing LSA scores are associated with decreasing health outcomes including kidney function (Bowling et al., 2014) and disability relating to activities of daily living (ADL) (Portegijs et al., 2016), while increasing scores can be a measure of surgical recovery after hospital discharge (Brown et al., 2009).

This study presents novel research in that the Life-Space Assessment can potentially inform us about how the spatial movement and frequency of movement for persons with SMI is associated with mental, physical and psychosocial health measures. Furthermore, mobility patterns can be assessed differentially for days when individuals visit psychiatric rehabilitation programs (PRP) and days that they do not. Days when the individuals do

not go the PRP can be particularly informative and can facilitate a better understanding of the underlying associations between health measures and mobility patterns.

OBJECTIVE

The objective of this study is to assess how measures of mental, physical and psychosocial health are associated with life-space at baseline and over follow-up for a population with serious mental illness. Examining these associations could highlight which health measures can be targeted to improve mobility and subsequent health.

METHODS

Study Population

Participants who were interested in taking part in the trial were screened from ten outpatient psychiatric rehabilitation programs across Maryland. All of the participants satisfied the criteria for SMI. Study inclusion criteria meant that individuals had to be overweight or obese, older than 18 years of age and attended 1 of 10 psychiatric rehabilitation programs or their affiliated outpatient mental health clinics. Exclusion criteria were based on medical contraindications to weight loss, a cardiovascular event in the last 6 months, inability to walk, or active substance abuse disorders. Enrolment was from January 2009 to February 2011.

ACHIEVE Trial

The ACHIEVE trial examined the effect of a lifestyle based intervention on weight loss among adults with SMI who attended community based PRP. The trial demonstrated that an 18-month lifestyle intervention could effectively result in significant weight-loss by

providing participants with SMI strategies to alter their behaviors when compared to the control group. The trial centers were located at outpatient psychiatric rehabilitation centers and the individuals in the intervention arm had both active group sessions and individual sessions targeted to improve their diets and promote physical activity. The control arm was provided with information and did not partake in physical activity sessions (Daumit et al., 2013). The current post-hoc analyses examine participant life-space at baseline, 6 month, and 18 month follow-up.

Measurements

Participant Characteristics. Standardized methods were used to assess height at baseline and weight at baseline, 6 months and 18 months. Age and primary psychiatric diagnosis (schizophrenia, schizoaffective disorder, major depression, bipolar disorder and other) were extracted from patient records. The participants self-reported their socio-demographic characteristics, living arrangements, marital status, and education.

Life-space was assessed using the Life-Space Assessment (LSA) Questionnaire (Appendix). The assessment is designed to reflect mobility patterns occurring over the last week based on the unit of daily scores. There are 5 spatial levels that an individual may move to and from: other rooms of the house; places outside the house; places in your neighborhood; place outside your immediate neighborhood; and places outside your town. The frequency of travel through these concentric levels is used to develop a sense of the range in movement for an individual. In addition, the participants may indicate if assistance was needed for achieving a particular spatial level.

A daily life-space score was calculated (LS-daily) indicating the average maximal spatial level achieved was adapted from the maximal life-space (LS-M) as seen in Baker et al, 2003. The LS-daily ranges from 0-5 with larger scores indicating greater life-spaces. For the purpose of this study, a general LS-daily was calculated as well as an LS-daily PRP on days the participant attended the PRP and LS-daily non-PRP, for those days the participant did not attend the PRP.

The life space composite score (LS-C) is the most commonly used and cited sub-scale. For each day, there is an option specifying if assistance is needed from another person in order to be mobile. If assistance is needed then a score of 1 is multiplied by the LS-M, and if assistance is not needed then a score of 2 is multiplied by the LS-M. The score is then multiplied by the frequency of the level achieved: 1=less than once a week; 2=1-3 times a week; 3=4-6 times a week; 4=daily. In total, the LS-C ranges from 0-120 with higher scores indicating a broader degree of independent movement throughout the week (Baker et al., 2003; Peel et al., 2005).

A clinically defined increase or decrease for the LS-C is defined as a 10-point change (Baker et al., 2003; Brown et al., 2009). For the LS-daily sub-scale, including the PRP and non-PRP sub-scales, the clinically defined increase or decrease is 1-point, which is based on the clinically defined increase or decrease for the LS-M (Baker et al., 2003).

For this study, four sub-scales are measured as primary outcomes: the LS-daily, LS daily PRP, LS-daily non-PRP and the LS-C.

Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D), which consists of 20 items that reflect depressive symptomatology (Radloff, 1977). Each item is scored from 0-3 with higher scores representing greater duration and severity. The total score is continuous and ranges from 0-60. The clinically defined cut-off for depressive symptoms is a score of 16 or more. The CES-D also has four factors that can be observed independently form one another. They include: depressed affect (7 items), positive affect (4 items), somatic symptoms (7 items) and interpersonal problems (2 items). Positive affect has a reversed direction in that higher scores signal a better response. These four factors are measured as continuous variables.

Symptoms and functional difficulties were assessed using the 24-item self-reported Behaviour and Symptom Identification Scale (BASIS-24) (Eisen et al., 2004). The overall summary is scored 0-4 with higher scores indicating greater severity of symptoms. The summary score is based on 6 subscales that are also scored from 0-4. The subscales include: depression and functioning, interpersonal relationships, psychosis, substance abuse, emotional lability and self-harm. The summary and sub-scale scores correlate well with other mental health measures including the SF-MCS (r: 0.12-0.75) (Eisen et al., 2004).

Self-reported health status was assessed using the 12-item Short Form Health Survey (SF-12) which includes a mental health composite score (MCS) and a physical health

composite score (PCS) that assess physical and emotional limitations based on a normalized score from 0 to 100 (Ware et al., 1996). The scales are designed to represent the average scores for the US population based on 10-year age categories. For the age range of 45-54, a mean of 50 and a standard deviation of 10 have been established. For a person who scores 44, this would indicate that 84% of the population has a better physical or mental health composite score within this age range. The mean score decreases to 47, 44 and 39 with each increase in age category 55-64, 65-74 and >75 respectively.

The EUROQOL EQ-5D Index score was another self-reported health scale that was utilized. The score is a composite quality of life measure that focuses on five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (Shaw, Johnson and Coons, 2005). The possible range for each of the dimension is 1 to 3, where 1=no problems, 2=moderate problems, and 3=extreme problems. The EQ-5D is calculated as a population preference-weighted index score that ranges from 0.0-1.0, in which 0=death and 1=perfect health.

Neighborhood characteristics were assessed using the Neighborhood Questionnaire that reflected the participant's perception of their built neighborhood environment (Mujahid et al., 2007). The questionnaire has 36 items that focus on seven dimensions. The first five dimensions are: aesthetic quality (6 items), walking environment (10 items), availability of healthy food (4 items), social cohesion (4 items) and safety (3 items). For these dimensions, participants respond to questions based on a likert scale (strongly agree=1,

agree=2, neutral -neither agree nor disagree=3, disagree=4 and strongly disagree=5). The sixth and seventh dimensions of violence (4 items) and activities with neighbors (5 items) are measured as (often=1, sometimes=2, rarely=3 and never=4). All of the dimensions are measured continuously from 0-5, except in the case of violence and activities with neighbors, which are scored 0-4 and have a reversed directionality.

Statistical Analysis

This was a *post-hoc* study that used an available data analysis approach by excluding participants with missing LSA data at 18 months follow-up. The covariate distribution was compared between the excluded participants and the total analytic group using t tests for continuous variables and chi-squared tests for categorical and nominal variables (Table 1).

1) Life-space change over time, testing the intention-to-treat principle

A stratified analysis was used to determine that group assignment was not associated with the LSA sub-scales over time; two methods were tested. The first method used t tests to compare mean LSA sub-scales. The sub-scales did not differ between group assignments at baseline or at 18 months ($p>0.05$). Also the change from 18 months to baseline did not differ between group assignments and the clinical change in the sub-scales did not change between groups over 18 months ($p>0.05$). The second method used likelihood-based mixed-effects models with an interaction term between visit and group assignment. After establishing that the group assignments did not significantly impact the sub-scales

longitudinally at 6 months and 18 months ($p>0.05$), the null hypothesis was supported: that no intervention effect was found.

2) Baseline associations between all covariates and life-space

At baseline, linear regressions tested the association of the covariates on all four life-space sub-sales (Table 2). Multiple linear regressions then adjusted for age, sex, race and group assignment (Table 3).

3) Associations between physical, mental and psychosocial health measures and life-space over time

Two models assessed the LSA crude change over time. The first model looked at the change from baseline to 18 months for the LSA sub-scales with paired t tests, to account for the within-subject correlation. The second model looked at the change in LSA from 6 months to baseline, and 18 months to baseline using likelihood-based mixed-effects, which allowed for random intercepts (Table 4). Clinically defined change for the LSA sub-scales were also observed, and presented as percentages for those who increased, decreased or remained stable (Table 5).

Since life-space was measured at three visits, likelihood-based mixed-effects models were the appropriate modelling technique to analyze life-space change over time. The model can account for baseline or cross-sectional associations as well as longitudinal associations (Louis, 1986; Neuhaus and McCulloch, 2006). For these analyses, the associations between health measures of interest and life-space were tested, and adjusted

for age, sex, race, site and visit. The regression model partitioned the baseline cross-sectional effect and the longitudinal effect of the predictors into two separate estimates (Table 6). A test of equality assessed if there was a significant difference between the estimates for the cross-sectional and longitudinal effects.

STATA (version 13.0 Stata Corporation, College Station, TX) was used for all analyses in this study. P-values were set to a significance level of 0.05.

RESULTS

Out of 417 potentially eligible participants, 291 were randomized and assigned to either the control group or the intervention group. Life space measurements were available for 244 participants at baseline and 46 people were excluded for missing outcome data at 18 months. After these exclusions, there was a total analytic population of 198 participants.

When comparing the total analytic group (N=198) to the excluded participants (N=46) at baseline, the former had a greater proportion that lived with a care provider or lived in a residential program (total analytic group: 56%, excluded participants: 39%, p=0.038) (**Table 1**). The total analytic group also scored higher on the SF-12 mental health composite score (p=0.018). The covariates were balanced across the groups. In the total analytic group, the average age was 45.5(SD=11.0), 53% were male, the mean weight was 221.4 pounds and the mean BMI was 35.4 kg/m^2. About 57% of the sample identified as white, 36% black and 6% other. Thirty percent did not complete high school, 74% were never married or single and 77% were unable to work. For health

insurance, 84% had Medicaid and 50% were eligible for Medicare. About 57% were ever smokers while 42% were current smokers. The primary psychiatric diagnoses were schizoaffective disorder (28%) and schizophrenia (27%), followed by bipolar disorder (22%), major depressive disorder (14%) and other disorders (8%). A large proportion (63%) had depressive symptoms based on the CES-D 16 cut-off. The mean CES-D score was 20.5 (SD=11.0). The SF-12 PCS-score had a mean of 44.5 (SD=10.3) and the EUROQOL 5D Index score had a mean of 0.80 (SD=0.2).

Age was associated with the LS-daily (-0.009 decrease in LS-C per year, p=0.03) and LS-daily non-PRP sub-scales (-0.014 decrease in LS-daily non-PRP per year, p=0.048) in the simple linear regression models (**Table 2**). The four CES-D factors were added into one model and positive affect was associated with increases in the LS-C (0.9, p=0.04), the LS-daily (0.037, p=0.01) and the LS-daily non-PRP (0.06, p=0.009) sub-scales. A less desirable walking environment was associated with a decrease in the LS-daily non-PRP sub-scale (-0.3, p=0.024). Declines in the LS-daily and the LS-daily non-PRP sub-scales were associated with less activities with neighbors: -0.2, p=0.01; and -0.2, p=0.036 respectively. After adjusting for age, sex, race and group assignment in the multiple linear regressions (**Table 3**), the same associations seen in the simple linear regression were observed, except age was marginal for the LS-daily non-PRP sub-scale (-0.013, p=0.06). Having a care-provider was also associated with a decreased LS-daily non-PRP sub-scale (-0.3, p=0.04).

In **Table 4**, baseline to 18-month measurements for the: LS-C was 69.68 to 71.71 (p=0.25); LS-daily 3.57 to 3.70 (p=0.012); and LS-daily non-PRP days 3.10 to 3.35 (p=0.002). A discrepancy in the LS-daily PRP sub-scale presented slightly different scores for Model 1: 4.05 to 4.05 (p=0.9); and Model 2: 4.05 to 4.04 (p=0.8). The clinical change in life-space for those who increased, decreased or remained stable is provided in **Table 5**. The LS-C scores increased, decreased and remained stable by about a third respectively. Just fewer than 77% remained stable for the LS-daily sub-scale, 73% remained stable for the LS-daily PRP sub-scale (N=163), and 61% remained stable for the LS-daily non-PRP sub-scale. The LS-daily non-PRP sub-scale had an increase of 26% compared to 13% for the LS-daily PRP sub-scale.

By observing the effect estimates from the mixed-effects models, the cross-sectional positive affect estimate at baseline was highly associated with an increase for all of the LSA sub-scales (LS-C: 0.9, SE=0.3, p=0.005; LS-daily: 0.04, SE=0.01, p<0.001; LS-daily PRP: 0.02, SE=0.009, p=0.02; LS-daily non-PRP: 0.07, SE=0.02, p<0.001) and an increase in the longitudinal effect estimate for depressed affect was associated with a decrease in the LS-daily non-PRP sub-scale (-0.03, SE=0.01, p=0.02) (**Table 6**). Somatic depressive symptoms were associated with a decrease in the LS-daily sub-scale for the longitudinal effect estimate (-0.02, SE=0.008, p=0.025). An increase in the longitudinal effect estimate of the CES-D total score was associated with a decrease in the LS-daily (-0.008, SE=0.003, p=0.03) and LS-daily non-PRP (-0.01, SE=0.005, p=0.03) sub-scales. For an increase in the longitudinal effect estimate of interpersonal relationship problems in the BASIS-24, the LS-C decreased (-2.4, SE=1.2, p=0.04) and the LS-daily also

decreased (-0.09, SE=0.04, p=0.02) (**Table 7**). A decrease in the LS-daily sub-scale was associated with less social cohesion for the longitudinal effect estimate (-0.1, SE=0.04, p=0.04). As activities with neighbors decreased, so did the LS-daily for the cross-sectional effect (-0.1, SE=0.05, p=0.038) and for the LS-daily non-PRP sub-scale, the longitudinal effect decreased as well (-0.2, SE=0.07, p=0.018) (**Table 8**). Other than a decrease in the LS-daily score for an increase in the cross-sectional effect estimate of the EQ-5D index (-0.4, p=0.049), no associations were found for any of the effect estimates for the SF-12 MCS, SF-12 PCS or the EQ-5D Index score (**Table 9**).

DISCUSSION

This is the first study to look at the Life-Space Assessment (LSA) or mobility patterning in general, in a population with serious mental illness. In total, 198 participants had their mobility patterns measured over 18 months and significant associations were found between mental, physical and psychosocial health measures and life-space. A major strength of the study is its longitudinal design and ability to conduct sophisticated statistical analyses. The cross-sectional and longitudinal findings provide us with a greater degree of detail to examine the underlying associations in this population.

A comparison of life-space can be made between this population and community dwelling older adults who predominate the life-space literature. We found that our population with SMI had a comparable life-space composite sub-scale at baseline (LS-C≅70) to a number of other studies looking at older persons. The Life-Space Mobility in Old Age (LIPSE) cohort from Finland has produced a number of studies for older persons

(aged 75-90) that also match our baseline LS-C estimate. They include older adults who: were not disabled according to ADL status (Portegijs et al., 2016), had unrestricted life-space (Viljanen et al., 2015), were goal seeking (Saajanaho et al., 2015), and were more likely to be men (Polku et al., 2015). Peel et al (2005) also found that increased life-space was more prevalent in males. Brown et al. (2009) had a similar LS-C for older persons who were not hospitalized and in Crowe et al. (2008) those aged 65-74 also had the same LS-C. Compared to a general population of older persons (75+), we found that persons with SMI scored 5-7 points higher (Crow et al., 2008; Baker et al., 2003; Peel et al., 2005; Saajanaho et al., 2015) and >20 points for ages 80+ in a study by Al Snih et al., (2012). These comparisons suggest persons with SMI have similar life-space to older persons with no disability and who are more likely to be male; this is a salient finding.

Despite differences in age and physical function, there are similarities between these populations for measures of mental health on life-space. At baseline, depressive symptoms have been strongly associated with a decreased life-space composite score (LS-C) in older people according to the CES-D (Polku, 2015; Viljanen et al., 2015; Al Snih, 2012; Boyle et al., 2010) and the geriatric depression scale (GDS) (Wheeler et al., 2014; Baker et al., 2003; Peel et al., 2005; Crowe et al., 2008). Our analyses looked at both baseline and longitudinal change in symptoms. We found that depressive symptoms based on the CES-D total score were associated with a decrease in the LS-daily sub-scale and the LS-daily non-PRP sub-scale over time, but not the LS-C sub-scale. Baker et al. demonstrated that much steeper declines in life-space over time were associated with baseline depressive symptoms (Baker et al., 2003).

Only one study has looked at the four CES-D factors with life-space (Polku et al., 2015), but it was cross-sectional. That study found that somatic symptoms were associated with a decreased LS-C, but found no significant associations for the other three factors. In our study, somatic symptoms were associated with a decline in the LS-daily sub-scale over time, while depressed affect was associated with a decrease in the LS-daily non-PRP sub-scale over time. Several studies have found evidence between poor physical health and somatic symptoms for older adults (Fonda and Herzog, 2001) and our findings could potentially reflect this phenomenon for persons with SMI.

Our study also explored more psychosocial measures than had previous studies.
If individuals do not go to the PRP, then it is not unreasonable to assume that they are more likely to remain homebound. Depression and lack of perceived social support can manifest into feelings of loneliness (Linz and Sturm, 2013; Aschenbrenner et al. 2013; Matthews et al., 2016) and it is possible that decreasing life-space reflected this. Two markers pertaining to worse psychosocial health were more pronounced for the LS-daily non-PRP sub-scale compared to the LS-daily PRP sub-scale, including depressed affect and activities with neighbors. According to Baker et al. (2003) the LS-M is a strong indicator of social support and lower scores correlate well with measures of mental health. We found evidence for this in that the LS-daily sub-scale decreased over time with lower levels of social cohesion. For the LS-daily non-PRP sub-scale, the same effect size was found but it was not statistically significant.

For all of the LSA sub-scales in our study, positive affect according to the CES-D was the strongest marker of increased life-space at baseline but the same association was not observed over time. Positive affect covers aspects of mental health including optimism, greater social connectedness and having a resilient coping response (Steptoe, Dockray and Wardle, 2009). Regular exercise is associated with greater positive affect in general (Steptoe et al., 2009) and our baseline results could be reflective of a pre-emptive feeling of positivity felt by the participants that was geared towards the life-style intervention.

Difficulties with interpersonal relationships according to the BASIS-24 but not the CES-D were associated with a decrease in the LS-C and LS-daily sub-scale. Mojtabai et al. (2014) found that delays in seeking mental health care were associated with worse depression and functioning according to the BASIS-24 questionnaire. In this study, not going to the PRP could possibly be reflected in the depressed affect seen for that sub-scale. In comparison to what Mojtabai et al. documented, we did find that effects were stronger on non-PRP days than on PRP days, although they were not statistically significant for the depression and functioning item the BASIS-24. Interpersonal therapy has been well documented and has been shown to be an effective behavioral intervention (Gallo et al., 2015; Dickerson et al., 2013).

This study had a few limitations: 1) It was a secondary data analysis. The intention-to-treat principle was tested to see if there was an intervention effect on life-space scores. Since no effect was found, group assignment was left out of the mixed models. 2) The analysis took the form of a cohort study and the sample size is naturally underpowered as

a result. This means that many of the associations could be underestimated. 3) The population under study represents community dwelling participants with SMI and is not representative of a population experiencing homelessness. It would be much harder to gauge life-space in a population without a defined home. 4) The population was defined as over-weight or obese and it is unclear if the same associations would be seen in normal BMI individuals with SMI. Ritchie et al. (2008) reported an arch-shaped relationship for BMI on life-space for older persons in their mid-seventies. The high-risk class (BMI>35) was 10 points lower than the overweight class (BMI>25 and BMI<30). It would be safe to assume that since the population under study is categorized as overweight or obese, the higher end of the BMI spectrum would produce similarly reduced estimates of life-space.

Note on the statistical models

There was almost 100% complete data for the 198 participants and missing data was not an issue. At 18 months, only the LS-daily PRP sub-scale had some missing life-space measurements (N=185) but this was negligible when the total observations were accounted for in the maximum likelihood-based mixed-effects models. Mixed-models work particularly well under a missing at random (MAR) missing data mechanism (Casagrande et al., 2010) when the mean and variation of the outcome can be observed and specified. In the case of the LS-daily PRP sub-scale, there was only 1% missing data for the total observations over follow-up.

By partitioning the health measures into cross-sectional and longitudinal components, differences in directionality between health measures and life-space were observed. The

cross-sectional effect of a health predictor could be a marker of mobility while the longitudinal effect may explain how the change in that predictor is associated with a change in life-space. Without specifying this difference, a longitudinal estimate alone does not explain the baseline association (Neuhaus and McCulloch, 2006). In addition, the effect estimates can even have opposite directionality (Adams et al., 1997). This bi-directionality can be observed in the variable self-harm for the BASIS-24 and social cohesion in the neighborhood questionnaire, in which an increase in the cross-sectional effect increases the LSA sub-scales but over time, the longitudinal effect is observed in the opposite direction, a decrease. To illustrate the statistical property of the test of equality, social cohesion produces a significant difference between these estimates for the LS-daily sub-scale.

CONCLUSION

The findings of this novel study suggest that life-space can be used to assess mobility patterns for persons with SMI and that this dimension of health can provide insight into a previously undocumented measure of health. The associations were more pronounced on days that individuals did not visit the PRP, indicating that social isolation could be associated with reduced mobility. The associations between decreasing life-space and worse health outcomes that have been established in community dwelling older adults were also observed in this population. Promoting social engagement could increase mobility as well as subsequent health in this population.

REFERENCES

Adams, M., Wilson, H., Casto, D., Berg, C., McDermott, J., Gaudino, J. and McCarthy, B. (1997) Constructing reproductive histories by linking vital records. Am. J. Epidemiology.145, 339–348.

Adams, R. E., Ritter, C., & Bonfine, N. (2015). Epidemiology of trauma: Childhood adversities, neighborhood problems, discrimination, chronic strains, life events, and daily hassles among people with a severe mental illness. *Psychiatry Research, 230*(2), 609-615.

Al Snih, S., Peek, K. M., Sawyer, P., Markides, K. S., Allman, R. M., & Ottenbacher, K. J. (2012). Life-space mobility in mexican americans aged 75 and older. *Journal of the American Geriatrics Society, 60*(3), 532-537.

Aschbrenner, K., Carpenter-Song, E., Mueser, K., Kinney, A., Pratt, S., & Bartels, S. (2013). A qualitative study of social facilitators and barriers to health behavior change among persons with serious mental illness. *Community Mental Health Journal, 49*(2), 207-212.

Avila, C., Holloway, A. C., Hahn, M. K., Morrison, K. M., Restivo, M., Anglin, R., et al. (2015). An overview of links between obesity and mental health. *Current Obesity Reports, 4*(3), 303-310.

Baker, P. S., Bodner, E. V., & Allman, R. M. (2003). Measuring life-space mobility in community-dwelling older adults. *Journal of the American Geriatrics Society, 51*(11), 1610-1614.

Baker, P. S., Bodner, E. V., Brown, C. J., Kennedy, R. E., & Allman, R. M. (2015). Life-space assessment composite score rationale. *Clinical Rehabilitation, 30*(1), 95-97.

Baller, J. B., McGinty, E. E., Azrin, S. T., Juliano-Bult, D., & Daumit, G. L. (2015). Screening for cardiovascular risk factors in adults with serious mental illness: A review of the evidence. *BMC Psychiatry, 15*, 55-015-0416-y.

Baughman, K. R., Bonfine, N., Dugan, S. E., Adams, R., Gallagher, M., Olds, R. S., et al. (2015). Disease burden among individuals with severe mental illness in a community setting. *Community Mental Health Journal,* [epub ahead of print]

Bowling, C. B., Booth, J. N.,3rd, Gutierrez, O. M., Kurella Tamura, M., Huang, L., Kilgore, M., et al. (2014). Nondisease-specific problems and all-cause mortality among older adults with CKD: The REGARDS study. *Clinical Journal of the American Society of Nephrology : CJASN, 9*(10), 1737-1745.

Boyle, P. A., Buchman, A. S., Barnes, L. L., James, B. D., & Bennett, D. A. (2010). Association between life space and risk of mortality in advanced age. *Journal of the American Geriatrics Society, 58*(10), 1925-1930.

Brown, C. J., Roth, D. L., Allman, R. M., Sawyer, P., Ritchie, C. S., & Roseman, J. M. (2009). Trajectories of life-space mobility after hospitalization. *Annals of Internal Medicine, 150*(6), 372-378.

Byles, J. E., Leigh, L., Vo, K., Forder, P., & Curryer, C. (2015). Life space and mental health: A study of older community-dwelling persons in australia. *Aging & Mental Health, 19*(2), 98-106.

Casagrande, S. S., Jerome, G. J., Dalcin, A. T., Dickerson, F. B., Anderson, C. A., Appel, L. J., et al. (2010). Randomized trial of achieving healthy lifestyles in psychiatric rehabilitation: The ACHIEVE trial. *BMC Psychiatry, 10*, 108-244X-10-108.

Center for Behavioral Health Statistics and Quality. (2015). Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health (HHS Publication No. SMA 15-4927, NSDUH Series H-50).

Choi, H., Irwin, M. R., & Cho, H. J. (2015). Impact of social isolation on behavioral health in elderly: Systematic review. *World Journal of Psychiatry, 5*(4), 432-438.

Crowe, M., Andel, R., Wadley, V. G., Okonkwo, O. C., Sawyer, P., & Allman, R. M. (2008). Life-space and cognitive decline in a community-based sample of african american and caucasian older adults. *The Journals of Gerontology.Series A, Biological Sciences and Medical Sciences, 63*(11), 1241-1245.

Daumit, G. L., Anthony, C. B., Ford, D. E., Fahey, M., Skinner, E. A., Lehman, A. F., et al. (2010). Pattern of mortality in a sample of maryland residents with severe mental illness. *Psychiatry Research, 176*(2-3), 242-245.

Daumit, G. L., Clark, J. M., Steinwachs, D. M., Graham, C. M., Lehman, A., & Ford, D. E. (2003). Prevalence and correlates of obesity in a community sample of individuals with severe and persistent mental illness. *The Journal of Nervous and Mental Disease, 191*(12), 799-805.

Daumit, G. L., Dickerson, F. B., Wang, N. Y., Dalcin, A., Jerome, G. J., Anderson, C. A., et al. (2013). A behavioral weight-loss intervention in persons with serious mental illness. *The New England Journal of Medicine, 368*(17), 1594-1602.

Dickerson, F. B., Yu, A., Dalcin, A., Jerome, G. J., Gennusa, J. V.,3rd, Charleston, J., et al. (2013). Cigarette smoking and health characteristics in individuals with serious mental illness enrolled in a behavioral weight loss trial. *Journal of Dual Diagnosis, 9*(1), 39-46.

Druss, B. G., Zhao, L., Von Esenwein, S., Morrato, E. H., & Marcus, S. C. (2011). Understanding excess mortality in persons with mental illness: 17-year follow up of a nationally representative US survey. *Medical Care, 49*(6), 599-604.

Eaton, W., Alexandre, P., Bienvenu, O., Joseph., Clarke, D., Martins, S. S., Nestadt, G., et al. (2012). Public mental health. In William Eaton (Ed.), *Public mental health* (1st ed., pp. 3-30). New York, NY: Oxford University Press.

Eisen, S. V., Normand, S. L., Belanger, A. J., Spiro, A.,3rd, & Esch, D. (2004). The revised behavior and symptom identification scale (BASIS-R): Reliability and validity. *Medical Care, 42*(12), 1230-1241.

Fonda, S.J., & Herzog, A. (2001). Patterns and risk factors of change in somatic and mood symptoms among older adults. *Annals of Epidemiology*, 11(6), 361-368.

Gallo, J. J., Hwang, S., Joo, J. H., Bogner, H. R., Morales, K. H., Bruce, M. L., et al. (2015). Multimorbidity, depression, and mortality in primary care: Randomized clinical trial of an evidence-based depression care management program on mortality risk. *Journal of General Internal Medicine,* [epub ahead of print].

Gardsjord, E. S., Romm, K. L., Friis, S., Barder, H. E., Evensen, J., Haahr, U., et al. (2016). Subjective quality of life in first-episode psychosis. A ten year follow-up study. *Schizophrenia Research,* [epub ahead of print].

Gothe, N. P., Fanning, J., Awick, E., Chung, D., Wojcicki, T. R., Olson, E. A., et al. (2014). Executive function processes predict mobility outcomes in older adults. *Journal of the American Geriatrics Society, 62*(2), 285-290.

Gutierrez-Rojas, L., Gurpegui, M., Ayuso-Mateos, J. L., Gutierrez-Ariza, J. A., Ruiz-Veguilla, M., & Jurado, D. (2008). Quality of life in bipolar disorder patients: A comparison with a general population sample. *Bipolar Disorders, 10*(5), 625-634.

Heald, A. H., Martin, J. L., Payton, T., Khalid, L., Anderson, S. G., Narayanan, R. P., et al. (2016). Changes in metabolic parameters in patients with severe mental illness over a 10-year period: A retrospective cohort study. *The Australian and New Zealand Journal of Psychiatry,* [epub ahead of print].

Henderson, D. C., Vincenzi, B., Andrea, N. V., Ulloa, M., & Copeland, P. M. (2015). Pathophysiological mechanisms of increased cardiometabolic risk in people with schizophrenia and other severe mental illnesses. *The Lancet.Psychiatry, 2*(5), 452-464.

Idland, G., Rydwik, E., Smastuen, M. C., & Bergland, A. (2013). Predictors of mobility in community-dwelling women aged 85 and older. *Disability and Rehabilitation, 35*(11), 881-887.

Jerome, G. J., Young, D. R., Dalcin, A., Charleston, J., Anthony, C., Hayes, J., et al. (2009). Physical activity levels of persons with mental illness attending psychiatric rehabilitation programs. *Schizophrenia Research, 108*(1-3), 252-257.

Jones, D. R., Macias, C., Barreira, P. J., Fisher, W. H., Hargreaves, W. A., & Harding, C. M. (2004). Prevalence, severity, and co-occurrence of chronic physical health problems of persons with serious mental illness. *Psychiatric Services (Washington, D.C.), 55*(11), 1250-1257.

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*(6), 617-627.

Linz, S. J., & Sturm, B. A. (2013). The phenomenon of social isolation in the severely mentally ill. *Perspectives in Psychiatric Care, 49*(4), 243-254.

Lo, A. X., Brown, C. J., Sawyer, P., Kennedy, R. E., & Allman, R. M. (2014). Life-space mobility declines associated with incident falls and fractures. *Journal of the American Geriatrics Society, 62*(5), 919-923.

Louis, T.A., Robins, J., Dockery, D.W. Spiro, A. III, & Ware, J. H. (1986). Explaining discrepancies between longitudinal and cross-sectional models. *Journal of Chronic Disease*. 39(10), 831-839.

Matthews, T., Danese, A., Wertz, J., Odgers, C. L., Ambler, A., Moffitt, T. E., et al. (2016). Social isolation, loneliness and depression in young adulthood: A behavioural genetic analysis. *Social Psychiatry and Psychiatric Epidemiology,*

McGinty, E. E., Baller, J., Azrin, S. T., Juliano-Bult, D., & Daumit, G. L. (2016). Interventions to address medical conditions and health-risk behaviors among persons with serious mental illness: A comprehensive review. *Schizophrenia Bulletin, 42*(1), 96-124.

Miller, B. J., Paschall, C. B.,3rd, & Svendsen, D. P. (2006). Mortality and medical comorbidity among patients with serious mental illness. *Psychiatric Services (Washington, D.C.), 57*(10), 1482-1487.

Mojtabai, R., Cullen, B., Everett, A., Nugent, K. L., Sawa, A., Sharifi, V., et al. (2014). Reasons for not seeking general medical care among individuals with serious mental illness. *Psychiatric Services (Washington, D.C.), 65*(6), 818-821.

Mujahid, M. S., Diez Roux, A. V., Morenoff, J. D., & Raghunathan, T. (2007). Assessing the measurement properties of neighborhood scales: From psychometrics to ecometrics. *American Journal of Epidemiology, 165*(8), 858-867.

Naslund, J. A., Aschbrenner, K. A., Scherer, E. A., Pratt, S. I., Wolfe, R. S., & Bartels, S. J. (2016). Lifestyle intervention for people with severe obesity and serious mental illness. *American Journal of Preventive Medicine, 50*(2), 145-153.

Neuhaus, J.M. and McCulloch, C.E. (2006). Separating between- and within-cluster covariate effects by using conditional and partitioning methods. *Journal of the Royal Statistical Society*. 68, 859-872.

Oldis, M., Murray, G., Macneil, C. A., Hasty, M. K., Daglas, R., Berk, M., et al. (2016). Trajectory and predictors of quality of life in first episode psychotic mania. *Journal of Affective Disorders, 195*, 148-155.

Peel, C., Sawyer Baker, P., Roth, D. L., Brown, C. J., Brodner, E. V., & Allman, R. M. (2005). Assessing mobility in older adults: The UAB study of aging life-space assessment. *Physical Therapy, 85*(10), 1008-1119.

Piatt, E. E., Munetz, M. R., & Ritter, C. (2010). An examination of premature mortality among decedents with serious mental illness and those in the general population. *Psychiatric Services (Washington, D.C.), 61*(7), 663-668.

Polku, H., Mikkola, T. M., Portegijs, E., Rantakokko, M., Kokko, K., Kauppinen, M., et al. (2015). Life-space mobility and dimensions of depressive symptoms among community-dwelling older adults. *Aging & Mental Health, 19*(9), 781-789.

Portegijs, E., Iwarsson, S., Rantakokko, M., Viljanen, A., & Rantanen, T. (2014). Life-space mobility assessment in older people in finland; measurement properties in winter and spring. *BMC Research Notes, 7*, 323-0500-7-323.

Portegijs, E., Rantakokko, M., Viljanen, A., Sipila, S., & Rantanen, T. (2016). Identification of older people at risk of ADL disability using the life-space assessment: A longitudinal cohort study. *Journal of the American Medical Directors Association,*

Radloff, L.S. (1977). The CES-D scale a self-report depression scale for research in the general population. Applied Psycho- logical Measurement, 1(3), 385-401.

Ritchie, C. S., Locher, J. L., Roth, D. L., McVie, T., Sawyer, P., & Allman, R. (2008). Unintentional weight loss predicts decline in activities of daily living function and life-space mobility over 4 years among community-dwelling older adults. *The Journals of Gerontology.Series A, Biological Sciences and Medical Sciences, 63*(1), 67-75.

Saajanaho, M., Rantakokko, M., Portegijs, E., Tormakangas, T., Eronen, J., Tsai, L. T., et al. (2015). Personal goals and changes in life-space mobility among older people. *Preventive Medicine, 81*, 163-167.

Shaw, J. W., Johnson, J. A., & Coons, S. J. (2005). US valuation of the EQ-5D health states: Development and testing of the D1 valuation model. *Medical Care, 43*(3), 203-220.

Stalvey, B.T., Owsley, C., Sloane, M.E., & Ball, K. (1999). The Life Space Questionnaire: A measure of the extent of mobil- ity of older adults. Journal of Applied Gerontology, 18(4), 460_478.

Steptoe, A., Dockray, S., & Wardle, J. (2009). Positive affect and psychobiological processes relevant to health. *Journal of Personality, 77*(6), 1747-1776.

Viljanen, A., Mikkola, T. M., Rantakokko, M., Portegijs, E., & Rantanen, T. (2015). The association between transportation and life-space mobility in community-dwelling older people with or without walking difficulties. *Journal of Aging and Health,*

Walker, E. R., McGee, R. E., & Druss, B. G. (2015). Mortality in mental disorders and global disease burden implications: A systematic review and meta-analysis. *JAMA Psychiatry, 72*(4), 334-341.

Ware, J.,Jr, Kosinski, M., & Keller, S. D. (1996). A 12-item short-form health survey: Construction of scales and preliminary tests of reliability and validity. *Medical Care, 34*(3), 220-233.

Wheeler, T. L.,2nd, Illston, J. D., Markland, A. D., Goode, P. S., & Richter, H. E. (2014). Life space assessment in older women undergoing non-surgical treatment for urinary incontinence. *Open Journal of Obstetrics and Gynecology, 4*(14), 809-816.

Table 1: Baseline characteristics of persons with Serious Mental Illness (SMI): comparing the total analytic group to the excluded participant group

	Groups		
	Total analytic N=198	**Excluded participants n=46**	
Characteristics	**Mean (SD)**	**Mean (SD)**	**P-value**
Age, year	45.5(11.0)	42.8(12.5)	0.15
Male sex — n(%)	105(53.0)	20(43.5)	0.24
Weight, lb.	221.4(44.2)	231.5(38.0)	0.15
BMI, kg/m^2	35.4(6.5)	36.5(6.5)	0.29
Race — n(%)			
White	114(57.6)	30(65.2)	0.49
Black	71(35.9)	16(34.8)	
Other	13(6.6)	-	
Hispanic ethnic group	9(4.6)	2(4.3)	0.95
Not a high-school graduate — n(%)	58(29.3)	16(34.8)	0.59
Never married/single — n(%)	146(73.7)	34(73.9)	0.98
Lives in residential program or with care provider — n(%)	111(56.1)	18(39.1)	**0.038**
Unable to work — n(%)	152(76.8)	38(82.6)	0.39
Health insurance — n(%)			
Medicaid	167(84.3)	37(80.4)	0.52
Medicare	99(50.0)	19(41.3)	0.29
Psychiatric diagnosis — n(%)			
Schizophrenia	53(26.8)	15(32.6)	0.53
Schizoaffective disorder	56(28.9)	10(21.7)	
Bipolar disorder	44(22.2)	14(30.4)	
Major depression	28(14.1)	4(8.7)	
Other	17(8.6)	3(6.5)	
Smoking — n(%)			
Ever	114(57.6)	32(69.6)	0.14
Current	83(41.9)	19(41.3)	0.94
CES-D			
16 cut-off — n(%)	125(63.1)	27(58.7)	0.58
Continuous 0-60	20.5(11.0)	19.5(11.2)	0.6
Positive affect 0-12	4.3(3.5)	4.1(2.9)	0.8
Interpersonal Problems 0-6	1.8(1.8)	1.6(1.7)	0.62
Somatic 0-21	7.7(40)	7.3(4.2)	0.57
Depressed affect 0-21	6.3(4.9)	6.3(5.1)	0.94
BASIS 24 Overall	1.2(0.6)	1.1(0.6)	0.7
Depression and functioning	1.3(0.8)	1.3(0.8)	0.82
Interpersonal relationships	1.3(0.8)	1.3(0.7)	0.94
Psychosis	0.3(0.6)	0.3(0.6)	0.94
Substance abuse	1.5(1.0)	1.3(1.0)	0.17
Emotional lability	1.0(1.0)	0.9(1.1)	0.61
Self-harm	0.3(0.6)	0.2(0.4)	0.6
SF-12 Mental Health	45.4(10.3)	41.2(12.4)	**0.018**
SF-12 Physical Health	44.5(9.9)	45.9(9.1)	0.38
EQ-5D Index Score	0.80(0.2)	0.8(0.2)	0.64
Neighbourhood Questionnaire			
Aesthetic Quality	2.8(0.6)	2.9(0.5)	0.32
Walking Environment	2.5(0.6)	2.6(0.7)	0.19
Availability of Healthy Food	2.7(1.1)	3.0(1.0)	0.12
Social Cohesion	2.5(0.8)	2.6(0.8)	0.58
Safety	2.7(1.0)	2.8(1.1)	0.39
Violence	3.5(0.6)	3.6(0.7)	0.31
Activities with Neighbour	2.9(0.8)	3.0(0.8)	0.35

*Bold signifies $p<0.05$. SD=standard deviation.

Table 2: The association between participant characteristics and Life-Space sub-scales at baseline using linear regression models

	Life-Space sub-scales			
	LS-C 0-120 N=198	**LS-daily 0-5 N=198**	**LS-daily PRP 0-5 N=185**	**LS-daily non-PRP 0-5 N=198**
Characteristics	**β (p)**	**β (p)**	**β (p)**	**β (p)**
Age (years)	-0.2(0.1)	**-0.009(0.03)**	-0.003(0.4)	**-0.014(0.048)**
Sex: Male	3.0(0.3)	0.1(0.2)	-0.1(0.5)	0.1(0.4)
Female (ref.)	68.0	3.5	4.1	3.0
Group: intervention	0.01(~1.0)	0.04(0.7)	0.05(0.6)	-0.1(0.7)
Control (ref.)	69.6	3.6	4.0	3.1
Race: Black	-2.5(0.4)	-0.2(0.1)	-0.07(0.4)	-0.2(0.2)
Non-black (ref.)	70.6	3.6	4.1	3.2
Living with family	-5.9(0.2)	-0.2(0.3)	0.2(0.1)	-0.5(0.06)
With room-mates	-5.9(0.2)	-0.2(0.07)	0.06(0.6)	**-0.6(0.002)**
Alone (ref.)	74.2	3.8	4.0	3.6
Care-provider	1.1(0.2)	-0.04(0.7)	-0.04(0.7)	-0.28(0.08)
None needed (ref.)	69.1	3.6	4.1	3.3
Weight lb.	-0.04(0.2)	-0.001(0.3)	-0.0003(0.8)	-0.001(0.5)
BMI kg/m^2	-0.3(0.2)	-0.008(0.3)	0.003(0.6)	-0.008(0.5)
Schizophrenia	-5.2(0.2)	-0.2(0.065)	**-0.3(0.003)**	-0.2(0.3)
Bipolar disorder	5.1(0.2)	0.04(0.8)	-0.1(0.3)	0.3(0.2)
MDD and Other (ref.)	71.4	3.7	4.3	3.1
CES-D 16 symptoms	-5.5(0.07)	-0.1(0.2)	-0.1(0.5)	-0.3(0.07)
No symptoms (ref.)	73.2	3.7	4.1	3.3
CES-D continuous	-0.1(0.3)	-0.004(0.4)	-0.005(0.2)	-0.004(0.5)
Positive affect*	**0.9(0.04)**	**0.037(0.01)**	0.02(0.07)	**0.06(0.009)**
Interpersonal problems	-.07(0.9)	0.01(0.7)	-0.04(0.08)	0.04(0.4)
Somatic	.03(0.9)	0.008(0.5)	-0.001(0.9)	0.01(0.6)
Depressed affect	-0.2(0.5)	-0.008(0.4)	-0.008(0.4)	-0.007(0.6)
BASIS-24 overall score	-1.5(0.5)	-0.05(0.5)	-0.01(0.9)	-0.09(0.4)
Depression and functioning	-0.9(0.6)	-0.04(0.5)	0.005(0.9)	-0.08(0.4)
Interpersonal relationships	-2.0(0.3)	-0.09(0.2)	-0.07(0.2)	-0.09(0.3)
Psychosis	-1.1(0.7)	0.02(0.8)	-0.04(0.6)	0.04(0.7)
Substance abuse	.003(1.0)	0.008(0.9)	0.03(0.4)	0.02(0.8)
Emotional lability	-0.4(0.8)	0.02(0.7)	-0.009(0.8)	-0.05(0.5)
Self-harm	0.8(0.8)	0.05(0.6)	-0.019(0.8)	0.11(0.4)
SF-12 MCS	-0.07(0.6)	-0.005(0.3)	-0.001(0.8)	-0.008(0.3)
SF-12 PCS	0.09(0.6)	0.003(0.5)	~0(1.0)	-0.0001(~1.0)
EQ-5D Index	-12.7(0.1)	-0.4(0.2)	-0.19(0.4)	-0.7(0.1)
Neighborhood Questionnaire				
Aesthetic Quality	-0.3(0.9)	-0.005(~1.0)	0.5(0.5)	-0.13(0.4)
Walking Environment	-0.8(0.7)	-0.05(0.5)	0.07(0.3)	**-0.3(0.024)**
Availability of Healthy Food	0.9(0.5)	0.0002(1.0)	0.018(0.7)	-0.03(0.7)
Social Cohesion	0.7(0.7)	-0.005(0.9)	0.007(0.9)	0.02(0.8)
Safety	-1.3(0.4)	-0.07(0.2)	-0.04(0.4)	-0.05(0.6)
Violence	-2.4(0.3)	-0.03(0.7)	-0.02(0.8)	-0.006(~1.0)
Activities with Neighbors	-3.4(0.1)	**-0.2(0.01)**	-0.001(~1.0)	**-0.2(0.036)**

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models are unadjusted. **β**=regression coefficient; $p<0.05$ and is signified in bold type.

* All four CES-D factors were run in one model and only positive affect was associated with the LSA sub-scales.

Table 3: The association between participant characteristics and Life-Space sub-scales at baseline using multiple linear regression models

	Life-Space sub-scales			
	LS-C 0-120 N=198	**LS-daily 0-5 N=198**	**LS-daily PRP 0-5 N=185**	**LS-daily non-PRP 0-5 N=198**
Characteristics	**β (p)**	**β (p)**	**β (p)**	**β (p)**
Age (years)*	-0.2(0.1)	**-0.01(0.024)**	-0.004(0.3)	-0.01(0.06)
Sex: Male	2.8(0.4)	0.12(0.2)	-0.07(0.4)	1.0(0.5)
Group: intervention	1.2(0.7)	0.1(0.4)	0.06(0.5)	-0.02(0.9)
Race: Black	-2.0(0.5)	-0.1(0.2)	-0.07(0.4)	-0.2(0.3)
Non-black (ref.)	79.0	4.0	4.3	3.7
Living with family	-5.6(0.3)	-0.2(0.3)	0.2(0.08)	-0.5(0.07)
With room-mates:	-6.1(0.1)	**-0.3(0.04)**	0.08(0.5)	**-0.7(0.001)**
Alone (ref.)	84.2	4.2	4.2	4.3
Care-provider	0.4(0.9)	-0.1(0.5)	-0.03(0.7)	**-0.3(0.04)**
None needed (ref.)	78.7	4.0	4.3	3.9
Weight lb.	-0.065(0.067)	-0.002(0.1)	-0.0002(0.9)	-0.002(0.2)
BMI kg/m²	-0.4(0.1)	-0.01(0.2)	0.002(0.8)	-0.01(0.3)
Schizophrenia	-6.9(0.067)	**-0.3(0.017)**	**-0.3(0.002)**	-0.3(0.2)
Bipolar disorder	3.8(0.4)	-0.03(0.8)	-0.2(0.2)	0.2(0.4)
MDD and Other (ref.)	80.2	4.1	4.5	3.8
CES-D 16 symptoms	-5.5(0.076)	-0.13(0.2)	-0.06(0.5)	-0.3(0.07)
No symptoms (ref.)	83.1	4.1	4.3	4.0
CES-D continuous	-0.1(0.4)	-0.003(0.5)	-0.006(0.1)	-0.004(0.6)
Positive affect	**0.9(0.05)**	**0.04(0.01)**	0.02(0.09)	**0.066(0.007)**
Interpersonal problems	0.6(0.6)	0.049(0.2)	-0.035(0.2)	0.09(0.1)
Somatic	0.3(0.5)	0.025(0.1)	0.009(0.5)	0.02(0.4)
Depressed affect	-0.3(0.5)	-0.023(0.1)	-0.001(0.9)	-0.03(0.3)
BASIS-24 overall score	-1.5(0.6)	-0.04(0.6)	-0.02(0.8)	-0.1(0.4)
Depression and functioning	-0.7(0.7)	-0.03(0.6)	-0.01(0.8)	-0.1(0.4)
Interpersonal relationships	-2.3(0.2)	-0.09(0.1)	-0.07(0.2)	-0.1(0.3)
Psychosis	-1.7(0.5)	-0.004(~1.0)	-0.43(0.5)	0.006(~1.0)
Substance abuse	0.01(~1.0)	0.009(0.9)	0.03(0.5)	0.02(0.8)
Emotional lability	-0.03(0.9)	0.03(0.5)	-0.004(0.9)	-0.04(0.6)
Self-harm	0.3(0.9)	0.03(0.7)	-0.02(0.8)	0.08(0.6)
SF-12 MCS	-0.06(0.5)	-0.006(0.2)	-0.0005(0.9)	-0.008(0.3)
SF-12 PCS	0.06(0.7)	0.002(0.7)	0.0007(0.9)	-0.0008(0.9)
EQ-5D Index	-14.7(0.09)	-0.5(0.1)	-0.2(0.4)	-0.8(0.1)
Neighbourhood Questionnaire				
Aesthetic Quality	-0.6(0.8)	0.02(0.8)	0.05(0.5)	-0.4(0.3)
Walking Environment	-0.4(0.9)	-0.04(0.6)	0.07(0.3)	**-0.3(0.04)**
Availability of Healthy Food	0.5(0.7)	-0.02(0.7)	0.01(0.8)	-0.06(0.4)
Social Cohesion	0.6(0.8)	-0.01(0.9)	0.001(~1.0)	0.007(0.9)
Safety	-1.8(0.3)	-0.09(0.067)	-0.04(0.3)	-0.08(0.3)
Violence	-2.3(0.3)	-0.04(0.7)	-0.03(0.7)	-0.005(~1.0)
Activities with Neighbour	-3.4(0.1)	**-0.2(0.01)**	-0.002(~1.0)	**-0.2(0.028)**

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models adjusted for age, sex, race and group. **β**=regression coefficient; $p<0.05$ and is signified in bold type.

* Age, sex, race and group covariates are in one model.

Table 4: Life-Space change from baseline to 18 months

		Life-Space sub-scales							
		LS-C N=198		LS-daily N=198		LS-daily PRP N=163		LS-daily non-PRP N=198	
Model		**Mean**	**P-value**	**Mean**	**P-value**	**Mean**	**P-value**	**Mean**	**P-value**
1	**Baseline**	69.68		3.57		4.05		3.10	
	18 month	71.71	0.25	3.70	**0.012**	4.05	0.93	3.35	**0.002**
2	**Baseline (ref.)**	69.68		3.57		4.05		3.10	
	6 Month	70.65	0.6	3.59	0.6	4.04	0.9	3.21	0.2
	18 month	71.71	0.23	3.70	**0.016**	4.04*	0.8	3.35	**0.002**

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. Model 1 uses paired t tests and Model 2 uses likelihood-based mixed-effects models. P<0.05 and is signified in bold type.
* For Model 2, N=195 for the LS-daily PRP sub-scale.

Table 5: Clinically defined change in Life-Space from baseline to 18 months

	Life-Space sub-scales			
	LS-C N=198	**LS-daily N=198**	**LS-daily PRP N=163**	**LS-daily no PRP N=198**
Clinical change	**n(%)**	**n(%)**	**n(%)**	**n(%)**
Increase	75(37.9)	29(14.7)	22(13.4)	50(25.3)
Stable	65(32.8)	152(76.8)	119(73.0)	121(61.1)
Decrease	58(29.3)	17(8.6)	22(13.4)	27(13.6)

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. Clinically defined change for the LS-C sub-scale is 10 points, and 1 point for the other LS-daily sub-scales (Baker, 2003).

Table 6: Cross-sectional and longitudinal associations of the CES-D score on Life-Space

	Life-Space sub-scales							
	LS-C N=198		LS-daily N=198		LS-daily PRP N=195		LS-daily non-PRP N=198	
Partitioned Effects	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**
CES-D								
Cross-sectional	-0.1(0.1)	0.2	-0.004(0.003)	0.3	-0.003(0.003)	0.2	-0.005(0.005)	0.3
Longitudinal	-0.1(0.1)	0.2	-0.008(0.003)	**0.03**	-0.004(0.003)	0.2	-0.01(0.005)	**0.03**
Test equality		~1.0		0.3		0.8		0.4
Positive affect								
Cross-sectional	0.9(0.3)	**0.005**	0.04(0.01)	**<0.001**	0.02(0.009)	**0.02**	0.07(0.02)	**<0.001**
Longitudinal	0.5(0.3)	0.2	0.02(0.01)	0.1	0.006(0.009)	0.5	0.02(0.02)	0.2
Test equality		0.2		0.056		0.1		**0.02**
Interpersonal problems								
Cross-sectional	-0.2(0.6)	0.8	0.01(0.02)	0.6	-0.02(0.02)	0.3	0.03(0.03)	0.4
Longitudinal	0.3(0.6)	0.6	-0.02(0.02)	0.3	-0.02(0.02)	0.2	-0.03(0.03)	0.4
Test equality		0.5		0.2		0.6		0.2
Somatic								
Cross-sectional	-0.1(0.3)	0.6	0.002(0.009)	0.8	-0.002(0.007)	0.8	0.008(0.01)	0.6
Longitudinal	-0.3(0.3)	0.2	-0.02(0.008)	**0.025**	-0.01(0.007)	0.1	-0.02(0.01)	0.07
Test equality		0.6		**0.047**		0.2		0.066
Depressed affect								
Cross-sectional	-0.2(0.2)	0.4	-0.005(0.008)	0.5	-0.002(0.006)	0.7	-0.007(0.01)	0.5
Longitudinal	-0.3(0.2)	0.3	-0.01(0.008)	0.1	-0.002(0.006)	0.7	-0.03(0.01)	**0.02**
Test equality		0.8		0.4		~1.0		0.2

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models adjust for visit, age, sex, race and site. The test of equality compares the cross-sectional and longitudinal estimates in the likelihood-based mixed-effects models. **β**=regression coefficient; SE=standard error; $p<0.05$ signified in bold.

Table 7: Cross-sectional and longitudinal associations between the BASIS-24 scores and Life-Space

	Life-Space sub-scales							
	LS-C N=198		LS-daily N=198		LS-daily PRP N=195		LS-daily non-PRP N=198	
Partitioned Effects	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**
BASIS-24								
Cross-sectional	-1.6(1.8)	0.4	-0.04(0.06)	0.5	-0.02(0.05)	0.7	-0.05(0.09)	0.6
Longitudinal	-2.7(2.0)	0.2	-0.08(0.06)	0.2	-0.03(0.06)	0.6	-0.1(0.1)	0.2
Test equality		0.6		0.6		0.8		0.5
Depression and Functioning								
Cross-sectional	-0.5(143)	0.7	-0.01(0.04)	0.7	-0.001(0.03)	~1.0	-0.04(0.07)	0.6
Longitudinal	-1.0(1.3)	0.4	-0.02(0.04)	0.6	0.02(0.04)	0.6	-0.06(0.07)	0.4
Test equality		0.7		0.9		0.6		0.8
Interpersonal Relationships								
Cross-sectional	-2.0(1.4)	0.2	-0.09(0.05)	0.056	-0.06(0.04)	0.1	-0.08(0.07)	0.3
Longitudinal	-2.4(1.2)	**0.04**	-0.09(0.04)	**0.02**	-0.05(0.04)	0.1	-0.09(0.06)	0.1
Test equality		0.8		~1.0		0.9		~1.0
Psychosis								
Cross-sectional	-1.8(1.9)	0.3	-0.01(0.06)	0.8	-0.02(0.05)	0.5	-0.01(0.1)	0.9
Longitudinal	-2.4(1.6)	0.1	-0.04(0.05)	0.4	-0.03(0.04)	0.6	-0.07(0.08)	0.4
Test equality		0.8		0.6		0.9		0.6
Substance abuse								
Cross-sectional	0.3(1.1)	0.8	0.01(0.04)	0.7	0.02(0.03)	0.5	0.04(0.06)	0.5
Longitudinal	-0.5(1.2)	0.7	-0.01(0.04)	0.8	-0.01(0.03)	0.7	-0.01(0.06)	0.8
Test equality		0.5		0.6		0.4		0.4
Emotional Lability								
Cross-sectional	-0.8(1.1)	0.8	0.006(0.04)	0.9	-0.005(0.03)	~1.0	-0.02(0.06)	0.7
Longitudinal	-0.3(1.2)	0.5	-0.02(0.04)	0.7	-0.03(0.03)	0.4	-0.04(0.06)	0.5
Test equality		0.7		0.6		0.5		0.8
Self-harm								
Cross-sectional	1.7(2.0)	0.4	0.1(0.07)	0.1	0.02(0.05)	0.7	0.2(0.1)	0.057
Longitudinal	-1.3(1.8)	0.5	-0.04(0.06)	0.5	-0.1(0.05)	**0.02**	0.01(0.1)	0.9
Test equality		0.2		**0.045**		**0.02**		0.1

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models adjust for visit, age, sex, race and site. The test of equality compares the cross-sectional and longitudinal estimates in the likelihood-based mixed-effects models. **β**=regression coefficient; SE=standard error; $p<0.05$ signified in bold.

Table 8: Cross-sectional and longitudinal associations between the Neighborhood Questionnaire scores and Life-Space

	Life-Space sub-scales							
	LS-C N=198		LS-daily N=198		LS-daily PRP N=195		LS-daily non-PRP N=198	
Partitioned Effects	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**
Aesthetic Quality								
Cross-sectional	0.1(2.0)	~1.0	-0.02(0.07)	0.8	0.02(0.05)	0.7	-0.1(0.1)	0.3
Longitudinal	1.4(1.5)	0.3	0.02(0.05)	0.6	0.02(0.04)	0.6	0.02(0.07)	0.8
Test equality		0.5		0.5		~1.0		0.3
Walking Environment								
Cross-sectional	0.8(1.8)	0.7	0.01(0.06)	0.8	0.02(0.05)	0.7	-0.08(0.09)	0.4
Longitudinal	1.5(1.6)	0.4	-0.01(0.05)	0.9	-0.01(0.05)	0.9	-0.03(0.08)	0.7
Test equality		0.7		0.7		0.6		0.6
Availability of Healthy Food								
Cross-sectional	1.0(1.0)	0.4	-0.001(0.03)	~1.0	0.006(0.03)	0.8	-0.01(0.05)	0.9
Longitudinal	2.2(0.9)	**0.02**	0.03(0.03)	0.4	0.05(0.03)	0.06	0.03(0.05)	0.5
Test equality		0.3		0.4		0.1		0.5
Social Cohesion								
Cross-sectional	1.1(1.4)	0.4	0.03(0.05)	0.6	0.01(0.04)	0.7	0.06(0.08)	0.5
Longitudinal	-0.7(1.3)	0.6	-0.1(0.04)	**0.04**	-0.04(0.04)	0.3	-0.1(0.07)	0.1
Test equality		0.3		**0.04**		0.3		0.057
Safety								
Cross-sectional	-0.2(1.1)	0.9	-0.02(0.04)	0.6	-0.03(0.03)	0.3	0.02(0.06)	0.7
Longitudinal	1.3(1.0)	0.2	0.02(0.03)	0.5	-0.03(0.03)	0.3	0.07(0.05)	0.2
Test equality		0.3		0.3		~1.0		0.5
Violence								
Cross-sectional	-1.9(1.8)	0.3	-0.03(0.06)	0.6	-0.01(0.05)	0.8	-0.03(0.1)	0.7
Longitudinal	-2.3(1.8)	0.2	-0.003(0.06)	~1.0	0.004(0.05)	0.9	-0.003(0.1)	~1.0
Test equality		0.9		0.7		0.9		0.8
Activities with Neighbors								
Cross-sectional	-0.8(1.5)	0.6	-0.1(0.05)	**0.038**	0.03(0.04)	0.5	-0.1(0.08)	0.056
Longitudinal	-0.2(1.3)	0.9	-0.08(0.04)	0.06	-0.01(0.04)	0.7	-0.2(0.07)	**0.018**
Test equality		0.7		0.7		0.4		0.9

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models adjust for visit, age, sex, race and site. The test of equality compares the cross-sectional and longitudinal estimates in the likelihood-based mixed-effects models. **β**=regression coefficient; SE=standard error; $p<0.05$ signified in bold.

Table 9: Cross-sectional and longitudinal associations between the SF-12 MCS, SF-12 PCS, EUROQOL 5D Index and Life-Space

	Life-Space sub-scales							
	LS-C N=198		**LS-daily N=198**		**LS-daily PRP N=195**		**LS-daily non-PRP N=198**	
	β (SE)	**p**	**β (SE)**	**p**	**β (SE)**	**p**	**β (SE)**	**p**
SF-12 MCS								
Cross-sectional	-0.04(0.1)	0.7	-0.001(0.004)	0.7	0.0007(0.003)	0.8	-0.001(0.01)	0.8
Longitudinal	-0.002(0.09)	~1.0	-0.0004(0.003)	0.9	-0.003(0.003)	0.2	0.002(0.004)	0.5
Test equality		0.8		0.8		0.2		0.5
SF-12 PCS								
Cross-sectional	0.05(0.1)	0.7	0.001(0.004)	0.7	-0.0004(0.003)	0.9	-0.001(0.06)	0.9
Longitudinal	0.06(0.1)	0.6	0.002(0.003)	0.6	0.002(0.003)	0.5	-0.003(0.005)	0.6
Test equality		0.9		0.9		0.5		0.8
EQ-5D Index								
Cross-sectional	-11.6(6.5)	0.07	-0.4(0.2)	**0.049**	-0.2(0.2)	0.2	-0.6(0.3)	0.1
Longitudinal	1.2(5.1)	0.8	-0.03(0.2)	0.8	0.07(0.1)	0.6	-0.03(0.3)	0.9
Test equality		0.06		0.08		0.08		0.1

Note: LS-C = life-space composite score; LS-daily PRP is the average maximal life-space over one week when participants visit the PRP; LS-daily non-PRP is the average maximal-life-space when participants do not go to the PRP. All models adjust for visit, age, sex, race and site. The test of equality compares the cross-sectional and longitudinal estimates in the likelihood-based mixed-effects models. **β**=regression coefficient; SE=standard error; $p<0.05$ signified in bold.

APPENDIX

The example on the next page is taken from page one of the LSA Questionnaire. Item (F) was not needed in this analysis. The section first asks about the spatial movement that occurred “yesterday”, and then moves on to the “day before yesterday” and so on until the past seven days are assessed. All of the LSA sub-scales used in this study can be scored from this questionnaire.

ACHiEVE
HEALTHY LIFESTYLES TRIAL
JOHNS HOPKINS

Participant ID: _ _ _ _ _ _ _ _ _ _ _ _

Staff ID: _ _ _

Date: _ _/_ _/_ _ _ _
Visit (check one): □ Baseline □ 6 Month □ 18 Month

Data Entered by (Staff ID): ___ ___ ___

Date Entered: ___ ___/___ ___/___ ___ ___ ___

Life Space Questionnaire

Today is _____, _____.
(day of week) (date)
We would like to ask you about places you may have been in the past week (last seven days). There are no right or wrong answers.

Lets start with YESTERDAY. Yesterday was**:** **Sun M T W Th F Sat**
(circle one)

1. Did you go to the (PRP) **yesterday**?
   - YES -1
   - NO -2

(If YES, ask question #2. If No, skip to question #3)

2. How did you get to (PRP)?
   - Van or driver from PRP picked you up 1
   - Family member or friend or caregiver drove you 2
   - Walk - 3
   - Public transportation – 4

3. **Yesterday**, did you travel to:
   A. Other rooms of your home besides the room where you sleep? O Yes -1 O No-2
   B. Places outside of your home, such as your porch, deck, patio, driveway or yard? O Yes -1 O N0-2
   C. Places in your neighborhood, other than your own yard or apartment building? O Yes -1 O No-2
   D. Places outside your immediate neighborhood, but within the city/county where you live? O Yes -1 O No-2
   E. Places outside of the city/county you live in? O Yes -1 O No-2
   F. Places outside of Maryland? O Yes -1 O No-2

(If YES to any of 3a-3f, ask #6. If NO to skip #7)

6. Did you need help from another person? O Yes – 1 O No – 2

---

7. Did you go to the (PRP) **the day before yesterday,** which was: **Sun M T W Th F Sat**
(circle one)
   - YES -1
   - NO -2

(If YES, ask question #8. If NO, skip to question #9)

8. How did you get to (PRP)?
   - Van or driver from PRP picked you up - 1
   - Family member or friend or caregiver drove you - 2
   - Walk - 3
   - Public Transportation - 4

Biographical Statement: Saul Feinstein obtained his B. Sc. from the University of Toronto (2013) majoring in Evolutionary Biology and Physical Geography. Upon graduation, he worked in Montreal at McGill University as a member of the Neuro-epidemiology Research Unit. He helped with data coding and literature reviews for the Canadian Longitudinal Study of Aging (CLSA). After Montreal, He went to Baltimore to obtain his Sc.M degree in Epidemiology from Johns Hopkins University (2016). He intends to work in the field of mental health research and epidemiology and will likely pursue a PhD after discovering what aspects in the field interest him the most. He is interested in the biological basis and life-course of affective disorders as well as the implementation of prevention strategies. Other than science and public health, Saul is a musician who sings and writes on the guitar. His future is taking him to Toronto where he can recreate a hometown musical project, while also working at the University Health Network pursuing research in mental health.